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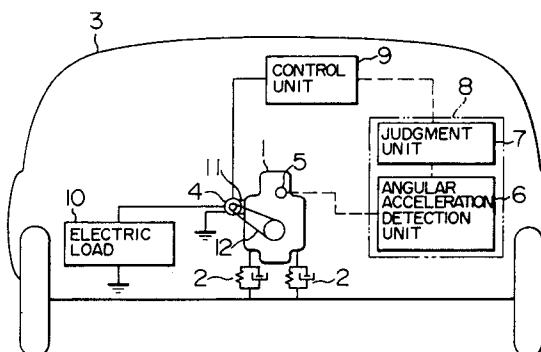
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EUROPEAN PATENT APPLICATION(21) Application number: **91114179.4**(51) Int. Cl.⁵: **G01M 15/00, F16F 15/00**(22) Date of filing: **23.08.91**(30) Priority: **28.08.90 JP 226388/90**(43) Date of publication of application:
04.03.92 Bulletin 92/10(84) Designated Contracting States:
DE FR GB(88) Date of deferred publication of the search report:
14.07.93 Bulletin 93/28(71) Applicant: **HITACHI, LTD.**
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Beetz jun. Timpe - Siegfried -
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W-8000 München 22 (DE)(54) **Apparatus and method for detecting abnormal combustion in internal combustion engine and apparatus and method for reducing vibration of internal combustion engine using the abnormal combustion detecting apparatus.**

(57) An apparatus for detecting abnormal combustion according to the present invention comprises: a unit (5, 16, 17, 19, 20) for detecting the rotation of an internal combustion engine (1); a unit (6) for calculating rotation angular acceleration on the basis of the detected rotation; a unit (7) for comparing the rotation angular acceleration with a predetermined reference value; and a unit (7) for judging whether abnormal combustion occurs. The apparatus for reducing vibration caused by abnormal combustion offsets vibration by passing a pulse-like field current in the electric generator (4) in response to detection of abnormal combustion to generate vibration torque in the electric generator.

F I G. 1**EP 0 473 079 A3**



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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	US-A-4 064 747 (R.J. RACKLIFFE) * column 2, line 50 - line 65 * * column 6, line 7 - column 7, line 19 * * column 7, line 42 - line 68; figures 1-3 * ---	1,3,5,6, 7,9,21, 23,24	G01M15/00 F16F15/00
Y	---	2,22	
Y	EP-A-0 164 873 (BORG-WARNER) * page 16, line 9 - line 15; figure 3 * ---	2,22	
X	IBM TECHNICAL DISCLOSURE BULLETIN vol. 32, no. 8A, January 1990, NEW YORK US pages 131 - 132 'CALCULATING EXACT POWER FROM FLYWHEEL DATA' * the whole document * ---	1,4,6,21	
X	PATENT ABSTRACTS OF JAPAN vol. 011, no. 239 (P-602)6 August 1987 & JP-A-62 050 637 (TANAKA) 5 March 1987 * abstract * ---	1,10,22, 25	TECHNICAL FIELDS SEARCHED (Int. Cl.5)
X	WO-A-9 007 051 (MOTOROLA) * claims 5-13 * ---	1,21	G01M F16F
A	US-A-4 044 234 (W.D. FROBENIUS) * column 4, line 43 - column 5, line 13; figure 1 * ---	13-18, 28-33	
E	WO-A-9 209 874 (SIEMENS) * page 3, line 8 - page 5, line 33; figures 1-3 * ---	1,21	
E	WO-A-9 209 875 (SIEMENS) * page 2, line 35 - page 6, line 28; figures 1-3 * ---	1,21	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 26 APRIL 1993	Examiner HEINSIUS R.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ----- & : member of the same patent family, corresponding document			



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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

- ☐ All claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for all claims.
- ☐ Only part of the claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid,
namely claims:
- ☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirement of unity of invention and relates to several inventions or groups of inventions,
namely:

See sheet -B-

- ☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.
- ☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid,
namely claims:
- ☐ None of the further search fees has been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims,
namely claims:



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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
E	EP-A-0 475 566 (FORD) * column 4, line 53 - column 8, line 23; figures 1-6 * ---	1-3, 5-10, 21-23, 24,25	
E	GB-A-2 245 933 (FUJI JUKOGYO) * page 18, last paragraph - page 30, last paragraph; figure 9 * ---	1-3, 5-18, 21-23, 24-33	
E	GB-A-2 244 516 (FUJI JUKOGYO) * page 7, paragraph 1 - page 26, paragraph 1; figures 1-9 * ---	1-3, 5-18, 21-23, 24-33	
D,A	PATENT ABSTRACTS OF JAPAN vol. 10, no. 378 (M-546)(2435) 17 December 1986 & JP-A-61 171 612 (TOYOTA MOTOR) 2 August 1986 * abstract * ---	1,21	
X	EP-A-0 354 790 (HITACHI) * page 4, line 4 - line 27; figure 1 * ---	19,20, 34,35	
X	PATENT ABSTRACTS OF JAPAN vol. 13, no. 265 (M-839)19 June 1989 & JP-A-10 66 450 (HITACHI) 13 March 1989 * abstract * --- -/--	19,20, 34,35	
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X	PATENT ABSTRACTS OF JAPAN vol. 12, no. 495 (M-780)23 December 1988 & JP-A-63 212 723 (HITACHI) 5 September 1988 * abstract *	19,20, 34,35			
X	--- PATENT ABSTRACTS OF JAPAN vol. 11, no. 149 (M-588)15 May 1987 & JP-A-61 283 737 (HITACHI) 13 December 1986 * abstract *	19,20, 34,35			
X	--- PATENT ABSTRACTS OF JAPAN vol. 13, no. 484 (M-886)2 November 1989 & JP-A-11 90 922 (HITACHI) 1 August 1989 * abstract *	19,20, 34,35			
X	--- PATENT ABSTRACTS OF JAPAN vol. 12, no. 134 (M-689)23 April 1988 & JP-A-62 255 534 (ISUZU) 7 November 1987 * abstract *	19,20, 34,35			
X	--- JP-A-63 212 723 (HITACHI) 5 September 1988 * the whole document *	19,20, 34,35	TECHNICAL FIELDS SEARCHED (Int. Cl.5)		
P,X	& US-A-5 033 425 (Y. KADOMUKAI)	19,20, 34,35			
P,X	--- EP-A-0 440 088 (HITACHI) * column 5, line 23 - column 7, line 44; claims; figures 1,5 *	19,20, 34,35			
P,X	--- EP-A-0 440 185 (HITACHI) ABSTRACT --- -/--	19,20, 34,35			
The present search report has been drawn up for all claims					
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<table><tr><td>CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</td><td>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</td></tr></table>				CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document	T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document
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P,X	DE-A-4 027 664 (NISSAN) * column 3, line 12 - column 4, line 50; figures 1-3 * -----	19,20, 34,35
		CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
		TECHNICAL FIELDS SEARCHED (Int. Cl.5)
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LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirement of unity of invention and relates to several inventions or groups of inventions, namely:

1. Claims 1-18 : An apparatus for detecting abnormal combustion in an internal combustion engine.
2. Claims 19-35 : An apparatus for reducing vibration in an internal combustion engine.